

## DIRECT PLUG-IN CONNECTION INCLUDING A CABLE END SLEEVE

Field of the Invention

The invention relates to a removable electrical plug-in connection made up of a connector and a mating connector; the mating connector includes a p.c. board and has at least one  
5 contact area which is connectable at least in part to the connector.

Description of Related Art

10 Plug-in connections in varied designs are known. As a rule, they are made up of a connector, e.g., a plug, which is insertable into a mating connector, e.g., a socket, in order to establish a removable electrical plug-in connection. Both  
15 connectors are connected to cables. With its outside diameter, the connector is in contact, at least in part, with the inside diameter of a socket of a mating connector, thereby establishing an electrical contact.

Other mating connector designs have p.c. boards on which  
20 switching elements are situated. In addition, these p.c. boards also have contact areas into which connectors are insertable. As a rule, these contact areas are sockets which are situated directly on the p.c. board.

25 The above-described design according to the related art has the disadvantage that this is not a reliable electrical connection which is able to withstand fretting corrosion. Micro-movements between the contacts and great insertion  
30 loosening, cause, in multipole plug-in connections in

particular, this type of corrosion which has an adverse effect on the quality of the electrical plug-in connection.

Furthermore, only expensive and, in technical terms, complex approaches for contacts are known, which meet the high

5 technical demands such as current transfer, insertion cycles, shaking, etc.

#### SUMMARY OF THE INVENTION

It is an object of the invention to propose a reliable  
10 electrical and removable plug-in connection in which a connector is contactable with a mating connector and in which the mating connector has a contact element, e.g., in the form of a board, p.c. board, or similar.

15 This and other objects of the invention are achieved by a removable electrical plug-in connection comprising a connector and a mating connector, the mating connector including a contact element, in particular a p.c. board, or similar, having at least one contact area which is connectable  
20 at least in part to the connector, wherein the connector includes at least one clamping element which grips at least in part around the contact element in its contact position, and this clamping element presses at least a part of the contact element against the contact area for establishing the  
25 electrical plug-in connection.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in greater detail with reference to the following drawings wherein:

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Figure 1 shows a perspective view of the mating connector according to the present invention including partially shown contact elements.

5 Figure 2 shows a perspective view of an exemplary embodiment of a contact element.

#### DETAILED DESCRIPTION OF THE INVENTION

One of the advantages of the present invention is that the  
10 proposed connecting technology is very space-saving and finds sufficient space in a housing of a connector. In addition, the connection may be securely established, so that an electrical plug-in connection is ensured in any type of combination of connector and mating connector.

15 Furthermore, it is an advantage that an electrical connection may be established directly so that the pins or male connectors of an electrical plug-in connection, customary per se, are no longer necessary. Pins or male connectors may be  
20 avoided in this way. In addition, this type of design of an electrical plug-in connection may be very easily used in sensors, valves, or similar components in which a removable electrical plug-in connection is to be implemented, but in which the necessary installation space for this is extremely  
25 limited.

Figure 1 shows a mating connector 1 in section. It is made up of a housing 2 as well as a contact element 3 situated in the housing, contact element 3 being a p.c. board in this  
30 exemplary embodiment. Connector 12 is made up of a contact carrier 11, contact element 6 and clamping elements 4 which are situated on both sides of contact elements 6. Contact

carrier 11 additionally has apertures 5, through which contact elements 6 are insertable. Connector 12 may include a plurality of contact elements 6 shown here (multi-pole plug connector).

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In contact position, as it is shown in Figure 1, contact elements 6 end in contact area 7 of contact element 3. The ends of the contact element 6 are designed in such a way that they are in contact on both sides of contact element 3 in its longitudinal extension, thereby establishing an electrical connection between contact element 6 and contact element 3 of mating connector 1. For fixing contact elements 6 on contact element 3, clamping elements 4 of contact carrier 11 are provided which, in the exemplary embodiment shown here, grip around the ends of contact element 6, at least partially, and press contact element 6 against contact areas 7 of contact element 3.

The clamping effect of clamping elements 4 may be created in different ways:

First, there is the possibility that clamping elements 4 are displaceably positioned elements which effect fixing of contact elements 6 either by joining contact carrier 11 or by using actuators, which are not shown in the drawing in greater detail.

Second, there is the possibility that clamping elements 4 have latching elements, into which contact elements 6 latch in their contact position (as shown in the drawing).

In order to create an optimized contact possibility between contact element 3 and contact element 6, provision is made to use contact element 6 including a sleeve 8 as it is shown in Figure 2. This sleeve 8 is made of an electrically conductive material which is slid over the contact area of contact element 6. Beads 10 are provided on outer surface 9 of sleeve 8 which create defined contact points with contact element 3 in contact area 7. As an alternative, sleeve 8 is also fixable via an at least partially insulated end of a cable, thereby creating a connector in a simple manner. This creates the possibility of omitting male connectors and pins and avoiding complex connecting methods between the male connectors or pins and the cable end.